2001 Cancer in Washington

Annual Report of the
Washington State Cancer Registry

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Executive Summary

This annual report of the Washington State Cancer Registry (WSCR) summarizes information on new cases of cancer (incidence) and death due to cancer (mortality) for Washington state residents. It represents the ongoing effort by the Department of Health, the Fred Hutchinson Cancer Research Center, the Blue Mountain Oncology Program, physicians, and cancer registrars throughout Washington.

This report represents a preliminary web-based version of a final report. In addition to the information currently posted, the final report will include information by race and ethnicity and it will describe trends in Washington for the 10 years of WSCR data currently available.

Cancer is a heterogeneous group of diseases characterized by uncontrolled growth and spread of abnormal cells. The various forms of cancer were responsible for 10,780 deaths among Washington residents in 2001, comprising approximately twenty-five percent of all deaths. In 2001, cancer (all types combined) was the most common cause of death among adults ages 45 to 74 and the second leading cause across all age groups. Some form of cancer will likely strike one in three Washingtonians in their lifetime. In 2001, there were 31,001 new cases of cancer diagnosed in Washington.

The report provides information on cancer of all types combined and the 24 cancer sites most frequently diagnosed in Washington residents. The information can be used at the state and county level to identify the burden of morbidity and mortality associated with each type of cancer. This information, combined with information on cancer prevention, early detection, and treatment, is useful for program planning and policy development aimed at reducing the burden of cancer.

The five most common types of cancer reported among Washington residents during 2001 were breast, prostate, lung, colorectal, and melanoma.

1 5,577 new cases and 756 deaths from female breast cancer were reported in 2001. Breast cancer was the second most common cause of cancer mortality for women. The age-adjusted rate of new breast cancers diagnosed in Washington women in 2001 was higher than the rate for the national comparison figures. However, the rate at which Washington women die of breast cancer was similar to the rate for the U.S. as a whole. Most risk factors for breast cancer are not easy to modify. However, among the potentially modifiable risk factors, obesity and alcohol consumption, especially more than one drink per day, increase the risk of breast cancer, and physical activity may decrease risk.[1,2] The best strategy for prevention of breast cancer mortality is early detection through screening. In 2002, 76% (± 2%) of Washington women met the National Cancer Institute's recommendations for mammography every one to two years beginning at age 40.

2 4,433 new cases and 592 deaths from prostate cancer were reported for 2001. It was the second leading cause of cancer death among men. No effective means are currently available to prevent the development of prostate cancer and experts continue to disagree on the benefits of screening for early detection of prostate cancer.

3 3,864 new cases of lung cancer were reported in 2001. 3,043 Washingtonians died of lung cancer, making it the leading cause of cancer mortality. The age-adjusted rate of new lung cancer cases in Washington was higher than the national rate, while mortality rates were similar. Reduction in smoking remains the major focus of efforts to prevent lung cancer.

4 2,937 new cases and 1,031 deaths from colorectal cancer were reported in 2001. The age-adjusted rate for new cancers of the colon and rectum was slightly lower in Washington than in the U.S. as a whole. Washington's mortality rate was also slightly lower than the national rate. Regular screening has been shown to reduce mortality.[1] In 2002, approximately one-half of Washington residents met the American Cancer Society's recommendations for screening. Research indicates that diets high in fat, protein, calories, alcohol and meat and low in calcium and folate may increase risk for colorectal cancer.[1] The American Cancer Society recommends a diet that includes at least five servings of fruit and vegetables every day and several servings of foods from other plant sources, such as grain products, rice or beans.[2] Regular physical activity may reduce the risk for cancer of the colon and rectum, and smoking may increase risk.[1,2]

5 2,184 new cases and 181 deaths from melanoma of the skin were reported in 2001. The age-adjusted rate for new melanomas was higher in Washington than in the U.S.; Washington's mortality rate was also slightly higher. Washington's racial distribution most likely plays a role. Rates are highest in white people and in Washington, 82% of the population reported white as their only race on the 2000 U.S. Census compared to 75% nationally. Avoiding sunburn, especially early in life, is effective in reducing incidence of melanoma.[1] The American Cancer Society recommends routine examination of the skin for reducing mortality from melanoma.[2] The National Cancer Institute advises patients that routine examination of the skin increases the chances of finding melanoma while it is still in an early, treatable stage.[1]

Preface

This annual report of the Washington State Cancer Registry (WSCR) incorporates cancer incidence data for the entire state. It represents the ongoing effort by the Department of Health, the Fred Hutchinson Cancer Research Center, the Blue Mountain Oncology Program, physicians, and cancer registrars throughout Washington. This information is presented in the hope that it will assist health care providers, public health officials, voluntary organizations, and concerned citizens in their efforts to prevent and control cancer in Washington.

This report represents a preliminary web-based version of a final report. In addition to the information currently posted, the final report will include information by race and if possible, ethnicity. It will also include additional information on trends in Washington.

Introduction

Cancer is a heterogeneous group of diseases characterized by uncontrolled growth and spread of abnormal cells. In 2001, there were 31,001 new cases of cancer diagnosed in Washington. The various forms of cancer were responsible for 10,780 deaths among Washington residents in 2001, comprising approximately twenty-five percent of all deaths. In 2001, cancer (all types combined) was the most common cause of death among adults aged 45 to 74 years and the second leading cause across all age groups. Some form of cancer will likely strike one in three Washingtonians in their lifetime.

Illness and death due to cancer are increasingly preventable through two types of strategies. Primary prevention strategies aim to reduce, usually through lifestyle change, the likelihood that a healthy individual will develop cancer. Secondary prevention is accomplished by screening asymptomatic people to diagnose cancers at an early, more readily treatable stage.

This report summarizes information on new cases of cancer (incidence) and deaths due to cancer (mortality) for Washington state residents and for comparative purposes, the U.S. as a whole. The report provides information on cancer of all types combined and the 24 cancer sites most frequently diagnosed in Washington residents. This information can be used at the state and county level to identify the burden of morbidity and mortality associated with each type of cancer. This information, combined with information on cancer prevention, early detection, and treatment, is useful for program planning and policy development aimed at reducing the burden of cancer.

The Five Most Common Cancer Sites

The most common types of cancer reported among Washington residents during 2001 were breast, prostate, lung, colorectal, and melanoma.

1 5,577 new cases of female breast cancer were reported in 2001. Breast cancer was by far the most frequently diagnosed cancer among women. Responsible for 756 deaths in 2001, it was the second most common cause of cancer mortality for women. While the age-adjusted rate of new breast cancers diagnosed in Washington women in 2001 continued to be higher than the national comparison rate, the rate at which Washington women died of breast cancer continued to be slightly below the national rate. This pattern has been evident for several years. In fact, for 1999 and 2000 Washington's rate of diagnosing women with invasive breast cancer was the highest in the nation. The Washington State Department of Health has determined that a portion of the high rate of breast cancer is related to relatively older ages at which Washington women have their first child compared to the U.S. as a whole. Other factors, such as rates of screening mammography, Washington's racial and age distribution, and the completeness of WSCR data do not seem to play a role. Additionally, while early stage at diagnosis* plays a role in survival, stage at diagnosis does not seem to explain the finding that the rate of new breast cancer cases was higher in Washington than in the U.S. as a whole, but mortality rates were lower. Washington women seem to be diagnosed at similar stages as women nationally, based on data available through SEER*Stat Version 5.0.20 client-server mode public use file, April 2003.

Rates of newly diagnosed breast cancer have been increasing in Washington since 1992. The overall rate of increase has been about 2% per year, with increases in situ and invasive disease of approximately 5% and 1% per year, respectively. Washington's increase for in situ breast cancer is similar to that seen nationally,[3] but the increase is slightly higher in Washington for invasive disease. In contrast to increasing incidence, rates of death from breast cancer have been decreasing in Washington slightly faster than nationally, approximately 3% per year compared to 2%.

The cause of most breast cancer is unknown and most of the known risk factors are not easy to modify. However, some risk factors are potentially modifiable. The National Cancer Institute and the American Cancer Society agree that obesity and alcohol consumption, especially more than one drink per day, increase the risk of breast cancer, and that physical activity may decrease risk.[1,2]

Early detection through mammography continues to be recommended by leading scientific organizations most of which conclude screening is effective in reducing deaths from breast cancer, especially for women between the ages of 50 and 65. The American Cancer Society recommends mammography every year for average-risk women beginning at age 40.[2] The National Cancer Institute and the U.S. Preventive Services Task Force recommend mammography every one to two years for women age 40 and older.[1,4] The 2002 Washington State Behavioral Risk Factor Surveillance System[5] indicates that 60% (± 3%) of women in Washington age 40 and older reported a mammogram in the past year and 76% (± 2%) reported a mammogram within the last two years.

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* See page 13 for a discussion of stage at diagnosis.

2 4,433 new cases of prostate gland cancer were reported in 2001 making prostate cancer the most commonly reported malignancy among men. It was the second leading cause of cancer death among men, killing 592 men in 2001. From 1992 – 1995 the incidence of prostate cancer declined in Washington. Since then, incidence has been increasing approximately 3% per year. This is similar to the national trend.[3] It is not known whether these changes reflect changes in screening practices, true changes in incidence or other factors. Since 1992, Washington's rate of death from prostate cancer has been decreasing about 5% each year, similar to the national trend.

No effective means are currently available to prevent the development of prostate cancer. The American Cancer Society recommends that health care providers offer prostate-specific antigen blood testing and digital rectal examination yearly for men age 50 and older, who do not have serious medical problems and can be expected to live for at least 10 years. They recommend that screening begin at age 45 for men at high risk, such as men with first-degree relatives with prostate cancer and African American men.[2] In contrast, both the U.S. Preventive Services Task Force and the National Cancer Institute conclude that there is insufficient evidence regarding the benefit of screening in reducing mortality to recommend for or against screening.[1,4]

3 3,864 new cases of lung cancer were reported for 2001. 3,043 Washingtonians died of lung cancer, making it the leading cause of cancer mortality. The age-adjusted rate of new lung cancer cases in Washington was higher than the national rate. Cigarette smoking is the major cause of lung cancer. Based on the Behavioral Risk Factor Surveillance Survey,[5] from 1990 - 2002, smoking rates have been about the same in Washington and the U.S. as a whole. However, lung cancer caused by smoking may take several decades to develop and we do not know whether there was more smoking in Washington than in the U.S. several decades ago. The mortality rates were similar in Washington and the U.S. as a whole.

The overall incidence rate for lung cancer in Washington has remained stable since 1992, but the pattern is different for men and women. Similar to the national trend,[3] the incidence rate for Washington men has been decreasing about 2% per year. For women, the pattern is more complex. The pattern in Washington women suggests an increase of about 2% per year since 1992, but the increase may now be leveling off. Nationally, incidence rates for lung cancer in women increased from 1988 – 1998 and then leveled off. Trends for Washington's death rates for lung cancer are similar to those seen nationally. For men there has been an average annual decrease of about 2% per year; for women there has been an increase of almost 1% per year.

Cigarette smoking is by far the most important cause of lung cancer. Nationally, approximately 90% of male and 78% of female lung cancer deaths are attributed to smoking.[1] An imaging technique (spiral computed tomography or spiral CT) has been successful in detecting early lung cancer in smokers and former smokers. The National Cancer Institute is currently conducting a large-scale study to determine whether screening smokers through spiral CT will reduce mortality from lung cancer. Currently, no major scientific organizations recommend routine screening for lung cancer. Reduction in smoking remains the major focus of prevention efforts.

4 2,937 new cases of colon and rectal cancer were reported in 2001. Colorectal cancer was the state's second leading cause of cancer death, resulting in the loss of 1,037 lives in 2001. The age-adjusted rate for new cancers of the colon and rectum was slightly lower in Washington than in the U.S. as a whole. Washington's mortality rate was also slightly lower than the national rate.

There have not been significant changes in overall incidence rates of colorectal cancer in Washington since 1992. National figures are available only for invasive disease. Nationally, invasive colorectal cancer has been decreasing about 3% per year from 1998 – 2000.[3] This decrease has not been seen in Washington. Rates of death from colorectal cancer have decreased in Washington about 2% per year since 1992. This is similar to the national trend.

The National Cancer Institute, American Cancer Society, and the U.S. Preventive Services Task Force conclude that screening average-risk individuals beginning at age 50 reduces mortality from colorectal cancer. There is less agreement about the best screening methods and frequencies. The most common screening methods include screening of the stool for invisible amounts of blood (fecal occult blood test or FOBT), visual examination of the lower bowel (sigmoidoscopy), and visual examination of the entire bowel (colonoscopy). The American Cancer Society recommends several screening options, with the preferred option as yearly FOBT combined with sigmoidoscopy every five years.[2] The U.S. Preventive Services Task Force also concludes that the evidence of benefit is strongest for a combination of FOBT and sigmoidoscopy, but the Task Force does not specify screening frequencies.[4] The National Cancer Institute concludes that FOBT every year or every two years reduces death from cancer from colorectal cancer and that sigmoidoscopy may reduce mortality, but there is insufficient evidence to determine how often people should have sigmoidoscopies.[1] The American Cancer Society recommends more frequent screening, beginning at earlier ages for those who may be more susceptible to colorectal cancer, such as people with a history of colorectal cancer in their family.[2]

The Washington State Behavioral Risk Factor Surveillance System[5] indicates that in 2002, 53% (± 3%), of Washingtonians age 50 and older reported a FOBT in the past year and/or a sigmoidoscopy or colonoscopy in the last five years. This is significantly higher than the 45% (± 2%) seen in the 1997 – 1999 combined data.

The National Cancer Institute states that colorectal cancer most likely results from complex interactions between inherited susceptibility and environmental factors. Research indicates that diets high in fat, protein, calories, alcohol and meat and low in calcium and folate may increase risk for colorectal cancer.[1] The American Cancer Society recommends a diet that includes at least five servings of fruit and vegetables every day and several servings of foods from other plant sources, such as grain products, rice or beans.[2] Regular physical activity may reduce risk especially for cancer of the colon, and smoking and obesity may increase risk.[1,2]

5 2,184 new cases of melanoma of the skin were reported in 2001. Melanoma accounted for 181 deaths in Washington residents. The age-adjusted rate for new melanomas was higher in Washington than in the U.S. as a whole. Washington's mortality rate was also slightly higher than in the U.S. We do not know why rates are higher in Washington than in the U.S., but our racial distribution most likely plays a role. Rates are highest in white people and in Washington, 82% of the population reported white as their only race on the 2000 U.S. Census compared to 75% nationally.

In Washington, overall rates of melanoma have been increasing approximately 6% each year since 1992, with invasive disease increasing approximately 4% each year. The rate of increase for invasive disease is similar to the national increase of about 3% per year from 1990 – 1996.[6] Analysis of national trend data for melanoma is not available for later years. However, SEER data suggest that the national increase may be leveling off after 1996.[7] Washington death rates for melanoma have not changed since 1992. This is

similar to the national pattern.[7]

There is evidence that avoiding sunburns, especially during childhood and adolescence, prevents melanoma.[1] Since some studies suggest that sunscreens do not protect against melanoma (they do protect against other types of skin cancer), avoiding exposure to the sun through other methods, such as wearing protective clothing, may be important in decreasing risk for melanoma.[1,2] The National Cancer Institute does not provide consistent advice on the importance of skin examination for early detection of melanoma. While it concludes that there is insufficient evidence that routine examination of the skin (by oneself or by a health care provider) is effective in reducing mortality from melanoma, it also advises patients that routine examination of the skin increases the chance of finding melanoma while it is still in an early, treatable stage.[1]

The American Cancer Society recommends skin examination by a health care professional as part of a routine cancer-related check-up. The American Cancer Society also recommends monthly self-examination and provides guidelines for recognizing signs of the disease. These include moles that are asymmetrical (that is, one side does not match the other), have irregular borders (that is, the edges of the mole are ragged or notched); have more than one color or shade; or are larger than about ¼ inch across. The guidelines can be easily remembered as A (**a**symmetrical), B (irregular **b**orders), C (more than one **c**olor) and D (**d**iameter of more than ¼ inch). A change in the size, shape or color of a mole may also be a sign of melanoma.[2]

Washington State Cancer Registry

Background

In 1990, RCW 70.54.230 made cancer a reportable condition in Washington and mandated the Department of Health to establish a statewide cancer registry program. Under this mandate, the Department established the Washington State Cancer Registry (WSCR) in 1991. The registry is dedicated to fulfillment of the legislative intent "...to establish a system to accurately monitor the incidence of cancer in the state of Washington for the purposes of understanding, controlling, and reducing the occurrence of cancer in this state." Since 1994, funding for WSCR has been provided, in part, through the Centers for Disease Control and Prevention's National Program of Cancer Registries. This program is designed to standardize data collection and provide information for cancer prevention and control programs at the local, state, and national levels. Certification of central cancer registries began in 1997 to recognize registries meeting data quality standards. This certification, Gold or Silver, is awarded through the National Association of Central Cancer Registries (NACCR). The Washington State Cancer Registry has achieved certification recognition each year it has been awarded.

Data Collection

Cancer cases are collected through a combination of contracts with two regional cancer registries and cases from independent reporting facilities (such as hospitals and clinics) with in-house cancer registry programs. The contractors and reporting facilities are responsible for case-finding, abstracting information on cancer from medical sources, and reporting cases to the statewide registry. The Cancer Surveillance System (CSS) of the Fred Hutchinson Cancer Research Center provides data on cancer cases from 13 counties in Western Washington, covering the majority of the state's population including the largest urban center of Seattle. CSS has been in operation since 1974 as a participant in the

Surveillance Epidemiology and End-Results (SEER) Program of the National Cancer Institute.

The remainder of the state is covered by reporting facilities with in-house cancer registry programs and the Walla Walla-based Blue Mountain Oncology Program (BMOP). BMOP is a consortium of cancer registries from 14 health care facilities in the Walla Walla, Tri-Cities, Sunnyside and Spokane areas. BMOP provides data from these facilities to WSCR. In addition, under contract to the Department of Health, BMOP provides staff to collect cases at facilities that do not have in-house cancer registries and conduct overall quality assurance activities according to national standards. WSCR also conducts regular data exchanges with cancer registries in 30 states. Most of Washington's out-of-state cases are reported by Oregon and Idaho, followed by Texas and Arizona.

Cancer cases are identified through reports from hospitals, pathology laboratories, radiation oncology centers, ambulatory surgical centers, cancer treatment centers, and physicians. Once the case is identified, an abstract of cancer information is completed within six months of diagnosis. Data files are transmitted from the contractors and reporting facilities to the state on a regular basis. WSCR is responsible for merging the data, conducting quality assurance in accordance with national standards, and disseminating cancer information to assist with cancer prevention and control efforts statewide.

The cancer reporting rules (246-102 WAC) currently define reportable cancers as "any malignant neoplasm, with the exception of basal and squamous cell carcinoma of the skin." Also specifically included are: 1) basal and squamous cell carcinoma of the external genital organs (vulva, labia, clitoris, prepuce, penis, anus, scrotum); 2) all brain tumors; 3) cancer in situ, except cancer in situ of the uterine cervix, and 4) certain hematopoietic conditions that have been recognized as pre-malignant. The legally required data for cancer reporting include patient demographics (such as age and sex) and medical information (such as type of cancer and date and stage at diagnosis) for all newly diagnosed cancers. Copies of Washington's cancer reporting legislation and regulations are available on request.

Report Contents

This report includes a chapter summarizing the incidence and mortality for all cancers combined and for the 24 cancer sites most frequently diagnosed in Washington residents. In addition to the chapters for each site, there are also introductory charts showing the relative frequency of the leading causes of cancer incidence and mortality and the age distribution of cancer diagnoses. Appendices include technical notes, sources of information on the epidemiology and prevention of cancer, the membership of the WSCR Advisory Council and WSCR contact information.

The report focuses on cases of cancer newly diagnosed between January 1, 2001 and December 31, 2001, and reported to WSCR as of September 2003. For some sections, other years of cancer incidence data are used, as well. Cancer incidence information is for residents of the entire state and also includes new cases of cancer among Washington residents diagnosed in other states, such as Oregon and Idaho. Mortality statistics focus on deaths among Washington residents that occurred in 2001 where the underlying cause of death was cancer. The cancer may have been diagnosed before 2001. As with incidence, some sections use mortality data from additional years and mortality data include Washington residents who die out-of-state.

The following material briefly describes the tables, graphs and charts presented in the chapters for each of the 24 cancer sites. It includes short discussions of the statistical methods used to produce each table, graph or chart, and special considerations for interpreting the data.

Tables, Charts and Graphs

Data Definitions and Sources

The Washington State Cancer Registry provides the number of new cases (incidence) of cancer as described above. Based on estimates of the expected number of cancer cases, the registry includes more than 95% of cases. Beginning in 2001, each cancer is coded to an International Classification of Diseases Oncology Third Edition (ICD-O-3) code. Data from earlier years is coded to the ICD-O Second Edition (ICD-O-2). The transition from ICD-O-2 to ICD-O-3 recognized and addressed advancements in diagnosing cancers that resulted in pathologists being able to provide more specific information about certain cancers. The most significant of these changes are seen in the coding schemes for lymphoma and leukemia.

For 22 of the 24 cancer sites covered in this report, the change from ICD-O-2 to ICD-O-3 reflects a more specific designation of an NOS (not otherwise specified) term. For leukemia and non-Hodgkin lymphoma, the ICD-O-3 added approximately 200 terms and synonyms. In the process of reorganizing the coding for lymphoma and leukemia, terms were moved to different codes and/or combined with other codes. The definition box for each leading cause of cancer provides the ICD-O-3 codes. We have used definitions that are consistent with those used by the National Cancer Institute's SEER program.

The Washington State Department of Health, Center for Health Statistics provides information from death certificates on the number and causes of death. According to the National Center for Health Statistics, more than 99% of all deaths occurring in the United States are registered in the death certificate system. Accuracy of reporting specific causes of death varies since classification of disease conditions is a medical-legal opinion subject to the best information available to the physician, medical examiner, or coroner certifying the cause of death. We obtained the number of cancer deaths from the Vital Registration System Annual Statistical Files, Washington State Deaths 1980-2002 CD-ROM issued November 2003.

From 1980 –1998, the underlying cause of death was coded using the International Classification of Diseases, 9th Revision (ICD-9) coding system. Consistent with national requirements, the Department of Health began using the International Classification of Diseases, 10th Revision (ICD-10) beginning with deaths occurring in 1999. While the change from the ICD-9 to the ICD-10 resulted in substantive changes in rates for some causes of death, the effect of the coding change is small for cancer. Information on the comparability of ICD-9 and ICD-10 codes is available from the National Center for Health Statistics (http://www.cdc.gov/nchs/datawh/nchsdefs/comparabilityratio.htm).

The data definition provides the ICD-10 codes used in each section. We have used definitions that are consistent with those used by the SEER program. **For some types of cancer, including brain, colorectal, endometrial, liver, leukemia, lung, multiple myeloma and thyroid, the SEER coding differs from the National Center for Health Statistics coding.** Before comparing information from different reports, one must be sure that the definitions are consistent.

Population data necessary for the calculation of rates are from the Washington State Office of Financial Management, November 2002. These include intercensal interpolations for 1992 – 1999, U.S. Census data for 2000, and postcensal estimates for 2001.

Incidence and Mortality Summary

These tables provide the number of new cases of cancer and the number of cancer deaths for Washington State residents in 2001. Since the numbers of new cases and deaths depend, in part, on the size of the population, we converted numbers to rates (e.g., the number of cases per 100,000 people) so that they may be compared among different regions or populations. For diseases, such as cancer, where incidence varies with age, the rates are age-adjusted to minimize the effect of different age distributions when comparing two geographic regions or populations.

Following national standards, we have age-adjusted rates to the 2000 U.S. standard population. **When making comparisons, one must be careful to compare age-adjusted rates that are adjusted to the same standard population and are calculated in the same manner.** Following the National Cancer Institute's standard method for age-adjustment, we have used 18 age groups to age-adjust. This is different from the standard 11 age groups used by the National Center for Health Statistics. For this reason, the rates in this report may differ slightly from those published in other state or national reports. Detail on our age-adjustment method is provided in Appendix A.

The final row of the incidence tables provides age-adjusted incidence rates from the twelve National Cancer Institute's SEER regions. These rates are from SEER*Stat version 5.0.20 client-server mode, public use file, April 2003. The final row of the mortality tables provides age-adjusted mortality rates for the U.S. These rates are available for the total U.S. population through SEER*Stat version 5.0.20 client-server mode public use file. SEER obtains these data from the National Center for Health Statistics. The SEER programs do not include data for 2001. Since cancer incidence and mortality rates do not change rapidly, we have provided 2000 national data for comparison.

Stage at Diagnosis

Stage at diagnosis refers to how far a cancer has spread from its site of origin when it is diagnosed. The stages, in order of increasing spread, are in situ, local, regional and distant. Cancers staged as local, regional, or distant are referred to as invasive. The reader should note that many publications of the National Cancer Institute and the Centers for Disease Control and Prevention report rates of invasive cancer only. Thus, caution must be exercised when comparing incidence rates contained in different reports.

The WSCR data contain the stage of disease at diagnosis coded according to the SEER guidelines.

In Situ	A tumor that fulfills all microscopic criteria for malignancy, but does not invade or penetrate surrounding tissue.
Localized	A tumor that is invasive but remains restricted to the organ of origin.
Regional	A tumor that has spread by direct extension to immediately adjacent organs or tissues and/or metastasized (spread through the blood stream) to regional lymph nodes, but appears to have spread no further.
Distant	A tumor that has spread by direct extension beyond the immediately adjacent organs or tissues, and/or metastasized to distant lymph nodes or other distant tissues.
Unstaged	Insufficient information available to determine the stage of disease at diagnosis

disease at diagnosis.

We have provided the frequency distribution of cases according to their stage at diagnosis.

For most cancers, diagnosis at an early stage (in situ or local) results in improved survival. One standard measure of survival is the five-year survival rate that estimates the proportion of individuals with a given cancer who are living five years after diagnosis. We have not developed five-year survival rates for Washington state residents. However, we have provided the SEER five-year survival rate for each cancer. These statistics were obtained from SEER*Stat version 5.0.20 client server mode public-use file, April 2003. This data file provides survival rates by stage of disease at diagnosis. The national five-year relative survival rates are calculated for cancer cases diagnosed between 1995 and 1999, based on follow-up of patients through 2000. The National Cancer Institute defines the relative five-year survival rate as the likelihood that a patient will not die from causes associated with their cancer within five years. The SEER*Stat program calculates this rate using a procedure described by Ederer, Axtell, and Cutler whereby the observed survival rate is adjusted for expected mortality.[8] It is always larger than the observed survival rate.[9]

Incidence and Mortality Rate Trends

These charts provide incidence and mortality rates from 1992 – 2001 for Washington residents per 100,000 population, age-adjusted to the U.S. 2000 standard population. (See "Incidence and Mortality Summary" for a discussion of age-adjusted rates.) These tables show changes in rates over time for females, males and the total population. As described in "Data Definitions and Sources" above, there were coding changes for new cancer cases in 2001 and for causes of death in 1999. For new cancer cases, the coding changes did not result in discontinuities from earlier data for the 24 cancer sites covered in this report. For death from cancer, there are likely small discontinuities due to the coding change. To reflect these discontinuities, the trend charts for mortality show a break between 1998 and 1999.

Incidence and Mortality Rates by County

We have presented the average annual age-adjusted cancer incidence and mortality rates for Washington residents per 100,000 population by county. (See "Incidence and Mortality Summary" for a discussion of age-adjusted rates.) Because of the small size of many counties and the relative rarity of some types of cancer, the incidence and mortality rates based on one year of data are not stable (i.e., there is some random fluctuation in rates from year to year). Therefore, for county rates, we have combined three years of data (1999-2001) to compute average annual age-adjusted rates for the three-year period.

The state rates and 95% confidence intervals are included for comparison purposes. While the incidence and death statistics in this report are not subject to sampling error, they may be affected by random variation. The confidence interval is used to describe the range of that variation.

When the confidence interval for the rate of interest does not overlap with the confidence interval for the comparison rate, the two rates are statistically significantly different, i.e., the difference between the two rates is more than that expected by random variation or chance. However, if we are making many comparisons, we may still find statistically significant differences just by chance. In fact, with a 95% confidence interval, we expect that 5% of the comparisons will be statistically significant by chance. If, for example, we compare rates for 24 cancer sites in 39 counties to state rates, we make 936 comparisons (24 times 39). Just

by chance alone, we expect to see statistically significant differences for about 46 (5% of 936) of those comparisons.

If the confidence interval for the rate of interest (for example, a confidence interval around a county rate) includes the rate for the comparison area (for example, the state rate), the rates are not statistically significantly different. When confidence intervals for the rate of interest and the comparison rate overlap, but the interval for the rate of interest does not include the rate for the comparison area, the differences may or may not be statistically significant and formal statistical testing may be needed.

Even with a three-year average, rates may fluctuate widely when there are a small number of cases. Therefore, we omit the rate and confidence intervals when there are fewer than five cases for the three-year period. Details of our methods for calculating confidence intervals are in Appendix A.

What's Missing

Information on Prevention, Early Detection, and Treatment

Illness and death due to cancer are increasingly preventable through the application of growing knowledge about the causes of cancer, improved screening, and early diagnosis techniques, and more effective treatment. Extensive information on prevention through changing modifiable risk factors, early detection through routine screening, and preferred treatment modalities is available. We have not attempted to reproduce this information in detail. However, a brief summary of the most important public health aspects of cancer prevention and control follows in the paragraphs below. Appendix B provides a resource list for those interested in more detail.

Screening for early detection has a clear role in reducing the disease burden due to cancer of the female breast, the uterine cervix, and colorectal cancer.[1] Experts do not agree on the value of routine screening of asymptomatic, average risk individuals for other types of cancer. However, the American Cancer Society supports clinical examination for early detection of prostate, skin, oral and testicular cancers, and self-examination for skin cancer.[2]

Major reductions in cancer rates and in an individual's likelihood of developing cancer are achievable through primary prevention strategies.

- The elimination of tobacco use would markedly reduce the incidence of lung cancer, as well as cancers of the oral cavity, pharynx, and esophagus. It would also reduce the incidence of bladder, kidney, pancreatic, and cervical cancer, and may reduce the incidence of colorectal cancer.[1]
- Diets high in fruit and vegetables may reduce the risk for cancer of the oral cavity, esophagus, stomach, prostate, and cervix. Diets low in fat, especially animal fat, might reduce risk of cancer of the prostate, breast, colon and rectum, and endometrium.[1] The American Cancer Society recommends eating at least five servings of fruits and vegetables each day; choosing whole grains in preference to processed grains and sugars; and limiting consumption of red meat, especially those high in fat and processed.[2]
- Regular, moderate exercise has also been shown to have some benefit in the prevention of cancer at a number of sites, such as colorectal and breast.[1] For optimal health, the U.S. Surgeon General recommends at least 30 minutes of moderate physical activity on five days a week.[10]

- Maintaining the proper body weight through a combination of a healthy diet and physical activity is important for cancer prevention. Obesity has been associated with an increased risk of cancers of the breast, colon, prostate, endometrium, cervix, ovary, kidney and gallbladder. Obesity may also be associated with cancers of the liver, pancreas, rectum and esophagus. Most likely the reasons for these associations are different for different types of cancer.[1]

The overall health benefit of these habits, and their lack of countervailing risk, makes them wise choices for cancer prevention. Health care providers, public health agencies, and voluntary organizations can provide the education that helps people make healthy choices.

While individual behavior plays an important role in cancer prevention, governmental and other societal entities have key roles as well. Policies and regulations that, for example, ban cigarette smoking, reduce youth access to tobacco, provide environments that encourage physical activity and healthy food choice, assure delivery of health services and control occupational exposures are important for preventing and controlling cancer.

Approaches for reducing the burden of cancer in Washington are included in the Washington State Comprehensive Cancer Control Plan.[11] The plan was developed by Washington's Comprehensive Cancer Control Partnership that includes cancer care providers, researchers, public health professionals, advocates, survivors, and others interested in cancer prevention and control. In establishing preliminary priorities, the Partnership relied on WSCR data to assess the burden of cancer in Washington. The overall purpose the plan is to facilitate a systematic approach to planning and implementing effective strategies to reduce the burden of cancer. The plan

- Provides a framework and guide for coordinated and integrated statewide efforts to reduce the burden of cancer.
- Highlights important cancer issues for future prioritization.
- Sets goals and objectives for improvement.
- Proposes evidence-based or theory-based strategies to achieve goals and objectives.
- Draw interested organizations and individuals together to work collaboratively toward shared goals.

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[1] National Cancer Institute (NCI). Cancer Information. http://cancer.gov/cancerinformation December 2003.

[2] American Cancer Society (ACS). http://www.cancer.org/ December 2003.

[3] Weir HK, Thun MJ, Hankey BF, et al. Annual Report to the Nation on the Status of Cancer, 1975 – 2000, Featuring Surveillance Data for Cancer Prevention and Control. JNCI 95: 1276-1299, 2003.

[4] U.S. Preventive Services Task Force. Guide to Clinical Preventive Services. (Clinical Categories, Cancer) http://www.ahrq.gov/clinic/cps3dix.htm#cancer December 2003

[5] The Behavioral Risk Factor Surveillance System (BRFSS) is a telephone survey of non-institutionalized adults. It is administered in all 50 states, the District of Columbia and Puerto Rico. The Washington BRFSS includes English-speaking people only. Information on the Washington BRFSS is available at http://www.doh.wa.gov/EHSPHL/CHS/CHS-Data/brfss/brfss_homepage.htm .

[6] Wingo PA, Ries LAG, Giovino GA, Miller DS, Rosenberg HM, Shopland DR, Thun MJ and Edwards BK. Annual report to the nation on the status of cancer, 1973-1996, with a special section on lung cancer and tobacco smoking. JNCI 91:675-689, 1999.

[7] Surveillance, Epidemiology, and End Results (SEER) http://seer.cancer.gov/faststats/html/inc_melan.html December 2003.

[8] Ederer F, Axtell LM, and Cutler SJ. The relative survival rate: a statistical methodology. NCI Monographs, 6:101-121, 1961.

[9] Ries LAG, Kosary, CL, Hankey BF, Miller BA, Clegg L, Edwards BK (eds.) SEER Cancer Statistics Review, 1973-1996. National Cancer Institute, Bethesda, MD, 1999

[10] U.S. Department of Health and Human Services. Physical activity and health: a report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996.

[11] Washington Comprehensive Cancer Control Partnership (WCCCP). Washington Comprehensive Cancer Control Plan, 2004 – 2008. CCCP, January 2004 (in press)

Appendices

Appendix A: Technical Notes

Appendix B: Sources of Additional Information

Appendix A: Technical Notes

Age-Adjustment

Age-adjusted incidence rates were developed using the direct method. They were standardized to the age distributions of the United States 2000 standard population. Following the age-adjustment procedures used by the National Cancer Institute we used five-year age groups in calculating age-adjusted rates. The age distribution of the 2000 US standard population is shown below.

US Standard Population Proportions

age group	2000 proportion
0 - 4	0.0691
5 - 9	0.0725
10 - 14	0.0730
15 - 19	0.0722
20 - 24	0.0665
25 - 29	0.0645
30 - 34	0.0710
35 - 39	0.0808
40 - 44	0.0819
45 - 49	0.0721
50 - 54	0.0627
55 - 59	0.0485
60 - 64	0.0388
65 - 69	0.0343
70 - 74	0.0318
75 - 79	0.0270
80 - 84	0.0178
85+	0.0155

Direct method of age adjustment

Multiply the age-specific rates in the target population by the age distribution of the standard population.

$$\hat{R} = \sum_{i=1}^{m} s_i (d_i / P_i) = \sum_{i=1}^{m} w_i d_i$$

Where m is the number of age groups, d_i is the number of deaths in age group i, P_i is the population in age group i, and s_i is the proportion of the standard population in age group i. This is a weighted sum of Poisson random variables, with the weights being $\left(s_i / P_i\right)$.

Confidence Intervals

Confidence intervals for the age-adjusted rates were calculated with a method based on the gamma distribution (Fay and Feuer, 1997). This method produces valid confidence intervals even when the number of cases is very small. When the number of cases is large the confidence intervals produced with the gamma method are equivalent to those produced with the more traditional methods, as described by Chiang (1961) and Brillinger (1986). The formulas for computing the confidence intervals are given below. Although the derivation of this method is based on the gamma distribution, the relationship between the gamma and Chi-squared distributions allows the formulas to be expressed in terms of quantiles of the Chi-squared distribution, which can be more convenient for computation.

$$\text{Lower Limit} = \frac{v}{2y}\left(\chi^2\right)^{-1}_{\frac{2y^2}{v}}\left(\alpha/2\right)$$

$$\text{Upper Limit} = \frac{v + w_M^2}{2(y + w_M)}\left(\chi^2\right)^{-1}_{\frac{2(y+w_M)^2}{v+w_M^2}}\left(1-\alpha/2\right)$$

where y is the age-adjusted death rate, v is the variance as calculated as shown below, w_M is the maximum of the weights $s_i P_i$, $1-\alpha$ is the confidence level desired (e.g., for 95% confidence intervals, α = 0.05), and $\left(\chi^2\right)^{-1}_x$ is the inverse of the χ^2 distribution with x degrees of freedom.

$$v = \sum_{i=1}^{m} d_i\left(s_i/P_i\right)^2$$

References

Brillinger, D. R. The natural variability of vital rates and associated statistics [with discussion]. *Biometrics* 42:693-734, 1986.

Chiang, C. L. Standard error of the age-adjusted death rate.*Vital Statistics, Special Reports* 47:271-285, USDHEW, 1961.

Fay, M.P. and Feuer, E.J. Confidence intervals for directly rates: a method based on the gamma distribution. *Stat Med*16:791-801, 1997

Appendix B: Sources of Additional Information

For more information on cancer, risk factors or prevention strategies please refer to the following resources:

1-800-4CANCER: A cancer information service of the National Cancer Institute

American Cancer Society, Western-Pacific Division: 1-800-729-1151 ext. 3307
American Cancer Society. 1998 Cancer Facts and Figures
American Cancer Society website, http://www.cancer.org/

American College of Surgeons National Cancer Database website: http://www.facs.org

Centers for Disease Control and Prevention website: http://www.cdc.gov/cancer/index.htm

Fred Hutchinson Cancer Research Center website: http://www.fhcrc.org/science

National Cancer Institute. Cancer Net: A Service of the NCI, http://cancernet.nci.nih.gov/

National Program of Cancer Registries website: http://www.cdc.gov/cancer/index.htm

Schottenfeld, David and Fraumeni, Joseph F. Jr. Cancer Epidemiology and Prevention, Second Ed. Oxford University Press, 1996.

Washington State Department of Health. The Health of Washington State. July 2002, http://www.doh.wa.gov/HWS.